APPENDIX A

TYPICAL DESIGN EXAMPLES

A-1. General. The following typical design examples illustrate procedures to be followed in the determination of total capacity requirements for water storage facilities at Army mobilization installations. Exact fire flow requirements should be evaluated according to EM 1110-3-166.

A-2. Example No. 1. Communications base.

a. Effective population.

- Nonresident: 400.
- Resident: 700.
- Total: 700 + 400/3 = 833.

b. Water source. Wells on post; average yield 150 gpm each.

c. Treatment. Chlorination.

d. Required daily demand and fire flows.

- Capacity factor: 1.5.
- Design population: 833 x 1.5 = 1,250.
- Per capita allowance: 150 gpd.
- Special demands: None.
- Required daily demand: 1,250 x 150 = 187,500 gpd, equivalent to a rate of 130 gpm.
- Firefighting flow: 500 gpm for 2 hours.
- Maximum day demand: 130 x 2.5 = 325 gpm.

e. Well requirements.

- Total well yield: Assuming 24-hour/day well operation, one well has sufficient yield to meet the required daily demand rate of 130 gpm. However, for firm production capability, it is necessary to have two wells, each capable of 130 gpm.

- Minimum pump requirement: The dependable output of the source of supply, i.e., the two wells, must be equal to, or greater than, the required daily demand. Thus, each well should be equipped with a 150-gpm pump. Two reliable sources of electric service should be provided, or one pump should be equipped with both an electric motor and standby internal combustion engine. The size and number of distribution pumps required are related to the type, size, and location of storage facilities. Provision of elevated storage will reduce the required pump capacity.

f. Storage requirement.

- Item 1: Fifty percent of total daily domestic requirements: 187,500/2 = 93,750 gallons.

- Item 2: Fire demand: (500 + 130/2) x 60 x 2 = 67,800 gallons. This item may be reduced by the amount of water available during the period of the fire demand under emergency conditions. The amount available under emergency conditions is the production of one well, so this item becomes 67,800 - (150 x 2 x 60) = 49,800 gallons.

- Item 3: Fifty percent of total daily domestic requirements plus the fire demand minus the production of one well in 24 hours: 93,750 + 67,800 - (150 x 24 x 60) = -54,450 gallons.

The largest of the above items, 93,750 gallons, governs the total storage requirements. Storage of not less than 100,000 gallons should be provided. In this case, it is suggested that a 100,000-gallon elevated tank be provided.

g. Water main sizes. The water distribution system will have mains of adequate size to meet peak domestic demand (see EM 1110-3-160) and pressure requirements at all locations. General design criteria for water mains are given in EM 1110-3-164.

A-3. Example No. 2: Mobilization camp.

a. Effective population.

- Nonresident: Negligible.

- Resident: 20,000.

b. Water source: Surface supply from river.

c. Treatment: Coagulation, flocculation, sedimentation, filtration, and chlorination.

d. Raw-water pump station: Two 2,700 gpm electric motor driven pumps and a 1,350 gpm dual-drive (electric motor with standby internal combustion engine) pump are available and have been delegated for use at this camp.

e. Required daily demand and fire flows.

- Capacity factor: 1.15.

- Design population: 20,000 x 1.15 = 23,000.

- Per capita allowance: 150 gpd.

- Required daily demand: (23,000 x 150) = 3,450,000 gpd. Gpd equivalent to a rate of 2,396 gpm.

- Maximum day demand: 2,396 x 2.5 = 5,990 gpm.

- Firefighting flows: (As would be determined from EM 1110-3-166).

- Quarters: 1,500 gpm for a duration of 2 hours = 1,500 x 60 x 2 = 180,000 gallons.

  Warehouse: 2,800 gpm for a duration of 3 hours = 2,800 x 60 x 3 = 504,000 gallons.

  Hospital: 1,500 gpm for a duration of 2 hours = 1,500 x 60 x 2 = 180,000 gallons.

To meet the required daily demand, a treatment plant with pump stations and appurtenances having a rated capacity of approximately 3.5 mgd would be provided. The emergency pumping capability of this plant will be 1,350 gpm as indicated in paragraph d above.

f. Storage requirements.

- Item 1: Fifty percent of total daily domestic requirements

$$= \frac{(23{,}000 \times 150)}{2} = 1{,}725{,}000 \text{ gallons}$$

- Item 2: Fire demand =

$$2{,}800 \times 60 \times 3 + \frac{(23{,}000 \times 150 \times 3)}{24 \times 2} = 719{,}630 \text{ gallons}$$

The storage requirement for fire demands becomes 719,630 - (1,350 x 60 x 3) = 476,630 gallons.

- Item 3: Fifty percent of required daily demand plus fire demand minus the amount of water available in 24 hours under emergency conditions = 1,725,000 + 719,630 - (1,350 x 60 x 24) = 500,630 gallons.

The first item governs; storage of about 1,800,000 gallons should be provided. At least 50 percent of the storage should be elevated since the population exceeds 10,000. Two 500,000 gallon elevated tanks would be satisfactory with the remainder of the required storage provided in a ground storage reservoir.

g. High-lift pump station. Pumping facilities, similar to those for raw water pump station, must be provided.

h. Water main sizes. Water mains will be in accordance with the criteria of EM 1110-3-164.